engcon®

Service Manual

Tiltrotator/Rotator EC/ECR02

The noble art of digging

ec™

Version 1.0

Table of contents

Safety regulations
General information 4
Cautions 4

Technical data
General information 6
Tightening 7
Permitted play 7

Tiltrotator/rotator EC02 8

Tilt cylinde
Removal 9
Dismantling 10
Assembly 11
Attachment 12

Directional valve/valve block, tilt cylinder
Removal 14
Attachment 16

Directional valve/valve block, frame
Removal 17
Attachment 17

Head
Removal 18
Attachment 18

Hydraulic motor
Removal 20
Attachment 20

Worm screw
Removal 21
Attachment 22

Worm wheel
Removal 23
Attachment 28

Checking of axial play
Axial play, worm wheel 33
Axial play, worm screw 35

Safety regulations

General information

In this service manual, the terms CAUTION, NB: and NOTE: are used as follows:

CAUTION

The term CAUTION signifies that incorrect procedures can cause personal injury.

NB:

The term NB: signifies that incorrect procedures can cause material damage.

NOTE:

The term NOTE: highlights important user instructions.

The service manual describes the repair and inspection operations that can be performed on tiltrotator/rotator ec 02.

The safety regulations apply regardless of which base machine is used. Also see the safety instructions for the base machine and other equipment used, as well as the safety information in the instruction manual.

Make sure you have read and understood all the cautions before undertaking any maintenance operations. The cautions explain potential risks and how to avoid them.

If in any doubt, contact your employer or the supplier. Expert advice can eliminate many unnecessary risks.

Cautions

CAUTION

Incorrect installation can pose a safety risk. If in any doubt, contact an engcon dealer or engcon Nordic AB.

CAUTION

Make sure that the hydraulic system is free of pressure before starting work on the system. Risk of personal injury.

CAUTION

Switch off the power when working with the electrical system and remove rings, watches etc. before starting work. Risk of personal injury.

CAUTION

Never use your hands to check for leaks in the hydraulic system. Hydraulic oil under pressure can penetrate your skin causing serious injury.

CAUTION

Implements connected to the tiltrotator/rotator may not be used under any circumstances unless correctly locked into place. ALWAYS make sure that the lock bolts protrude according to the specifications for the relevant quick hitch.

CAUTION

Never attempt to upgrade the equipment's maximum capacity by making modifications without the supplier's approval.

CAUTION

Short circuits in electrical cables can cause injury and burning. Insulate electrical conductors and parts carefully when installing electrical equipment.

CAUTION

Risk of burn injuries from hot hydraulic oil.

CAUTION

The machine must never be operated with the implement lock switch turned on, except when attaching or detaching a bucket or implement.

CAUTION

If in any doubt regarding the machinery or the safety features, contact an engcon dealer or engcon Nordic AB.

CAUTION

Risk of catching in moving parts.

Technical data

General information

Max. machine size	3 000 kg
Max. breakout	20 kNm
Max. bucket width	800 mm
Max. hydraulic pressure	22,5 MPa
Min./max. hydraulic flow	15/35 l/min
Max. rec. pressure in return line	2,5 MPa
Weight	65 kg*
Width A	180 mm*
Width B	155 mm*
Width C	160 mm*
Total length D	435 mm*
Build height E	245 mm*
Max. width	385 mm*
Swivel channel extra function, number of couplings	2
Swivel channel lock function, number of couplings	2
Rotation	Infinite
Tilt angle	2x40°
Tilt time, hydraulic flow	2s / 10 l/min
Rotation time for one rotation, hydraulic flow	4,6 s / 35 l/min
Hydraulic motor Char-Lynn, J lin	50 cm^3
Standard mountings	S30, S40

*Depends on mounting

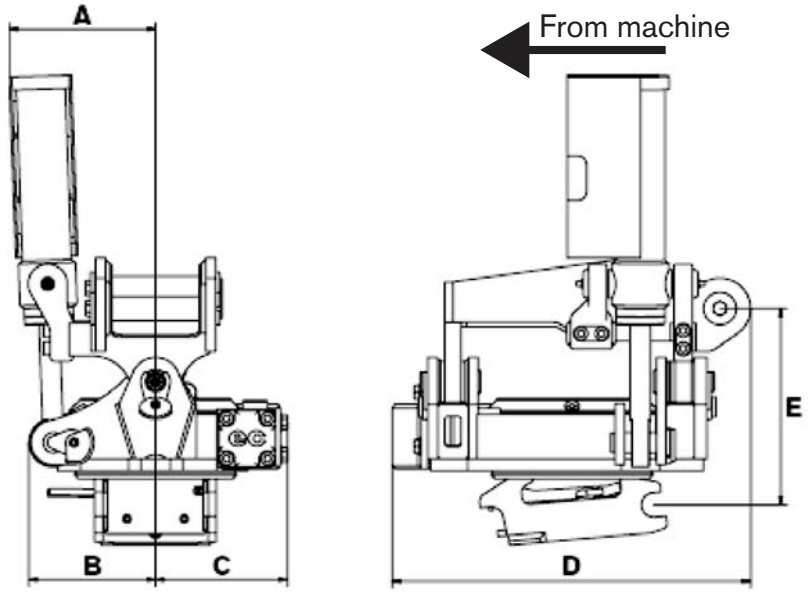


Fig. 1. Measurement table

Tightening

The rotator is dimensioned to withstand heavy strain from breakout and rotation. Tightening of certain screw joints is vital to ensure optimum durability.

Screws and thread holes must be kept very clean and the threads well lubricated.

Screw dimension	8.8 Type	12.9 Typ
M5	5,7 Nm	9.7 Nm
M10	47 Nm	80 Nm
M12	81 Nm	140 Nm

The screws for the hitch, centre ring and yoke couplings must be replaced during servicing.

The replacement screws should be of the same type as the previous screws.

Permitted play

Axial play, worm screw A	Axial play, worm wheel B
Max. 0.4 mm	Max. 0.3 mm

NOTE:

After shimming, the values should be between 0.1 mm and 0.2 mm.

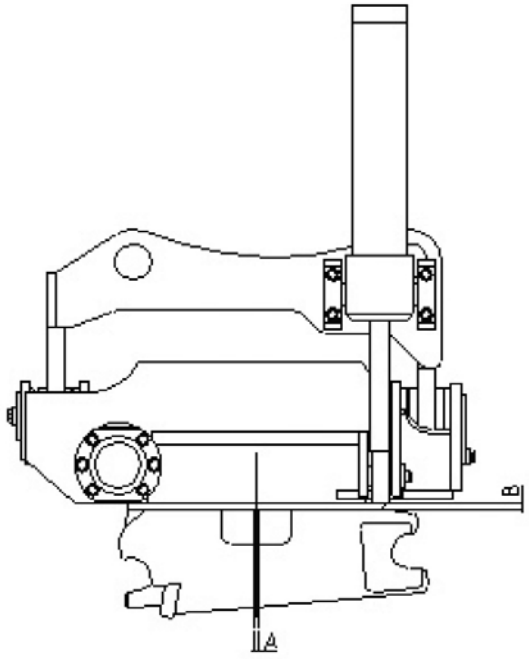


Fig. 2. Overview, play

Axial play worm screw A.

Axial play worm wheel B.

Tiltrotator/Rotator EC02

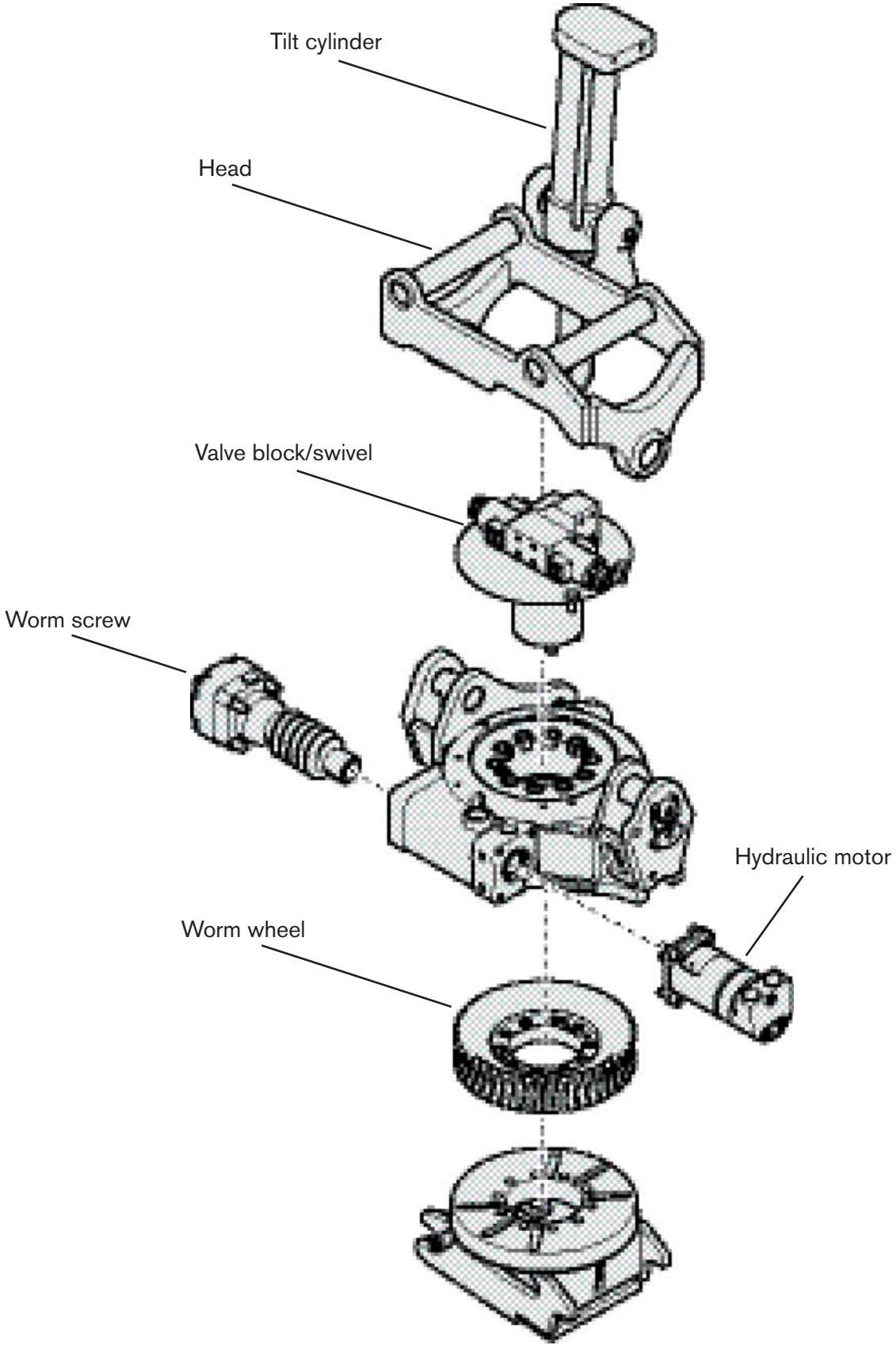


Fig. 3. Assembly diagram, rotator EC02

Tilt cylinder

Removal

CAUTION

Make sure that the hydraulic system is free of pressure before starting work. Risk of personal injury.

NB:

All work that involves opening up connections to hydraulic parts requires a high degree of cleanness.

1. Clean the tilt cylinder and its hydraulic connections.
2. Mark the positions of the two hydraulic tubes.
3. Disconnect the hydraulic tubes attached to connection A and connection B on the tilt cylinder's valve block.
4. Plug all open connections.

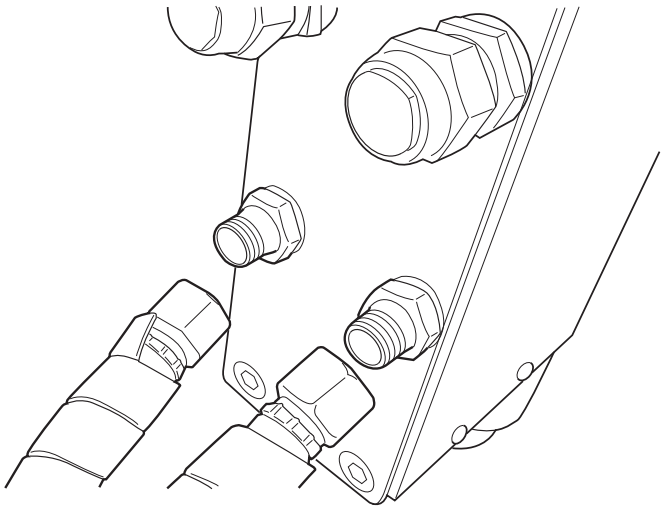


Fig. 4. Hydraulic connections, valve block

5. Remove the cable ties around the tubes.
6. Remove the two power plugs from the rotator's valve block.
7. Remove the cylinder coupling that is turned towards the base machine.
8. Remove the lock screw for the cylinder shaft and remove the shaft.

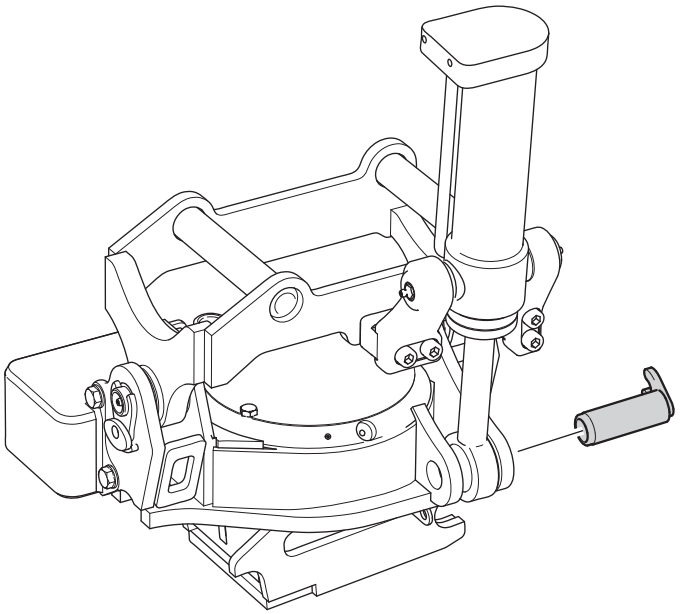


Fig. 5. Cylinder shaft

CAUTION

Risk of catching in moving parts.

9. Lift off the tilt cylinder with the valve package from the cylinder coupling that is turned away from the machine.
10. Remove the protective plates covering the tilt cylinder's valve package.
11. Remove the valve block from the tilt cylinder, making sure that O-rings come away with it.

Dismantling

NB:

All work that involves dismantling of hydraulic parts requires a high degree of cleanness.

1. Clean the outside of the cylinder.
2. Clamp the cylinder in a vice.
3. Remove the cylinder nut and empty any remaining oil from the cylinder.
4. Pull out the piston rod along with its seals.

NOTE:

The piston is fixed with Loctite. If necessary, heat gently to facilitate removal.

5. Remove the piston from the piston rod.
6. Remove the cylinder nut from the piston rod.

Assembly

1. Check the piston rod, piston and cylinder for damage or scratches.
2. Replace all seals.

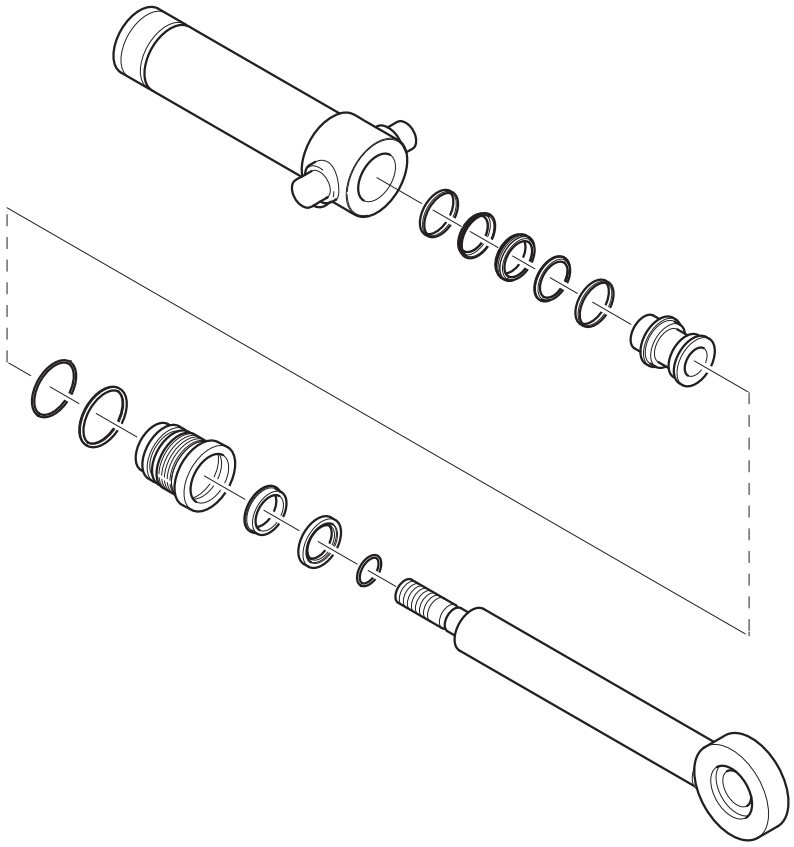


Fig. 6. Tilt cylinder, assembly diagram

3. Lubricate the seals in the cylinder nut with clean hydraulic oil and thread it onto the piston rod.
4. Apply lock solution to the piston and mount it on the piston rod.
5. Make a punch mark on the bottom between the piston and the piston rod to secure the piston.
6. Lubricate the new seals on the piston with clean hydraulic oil and push the piston rod into the cylinder.
7. Screw the cylinder nut into place.

Attachment

1. Attach the valve block with the directional valve.
   Check that the O-rings are correctly in place.

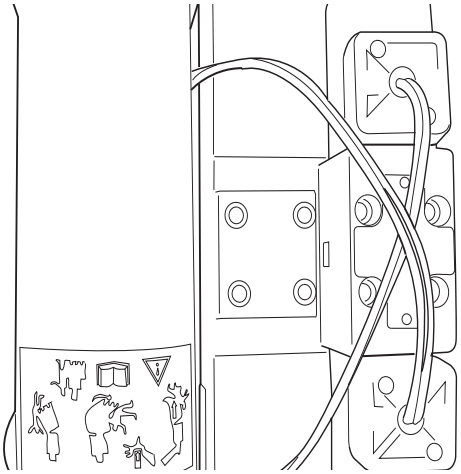


Fig. 7. O-rings

2. Attach the protective plate without a type plate to the valve block.

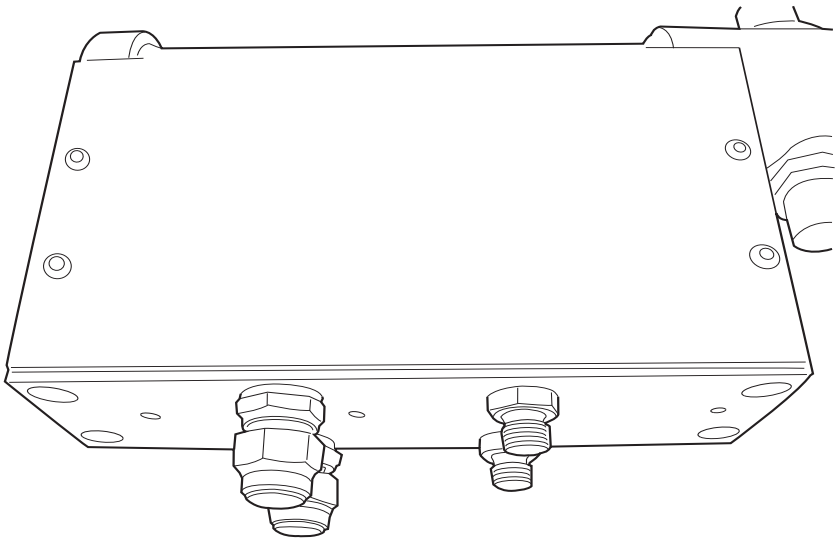


Fig. 8. Protective plate without type plate

3. Make sure that the cables are not rubbing against any sharp edges.
4. Attach the protective plate with a type plate.
5. Lubricate the bushes for the tilt cylinder.
6. Install the cylinder in the hitch that is turned away from the base machine.

7. Attach the hitch that is turned towards the base machine.

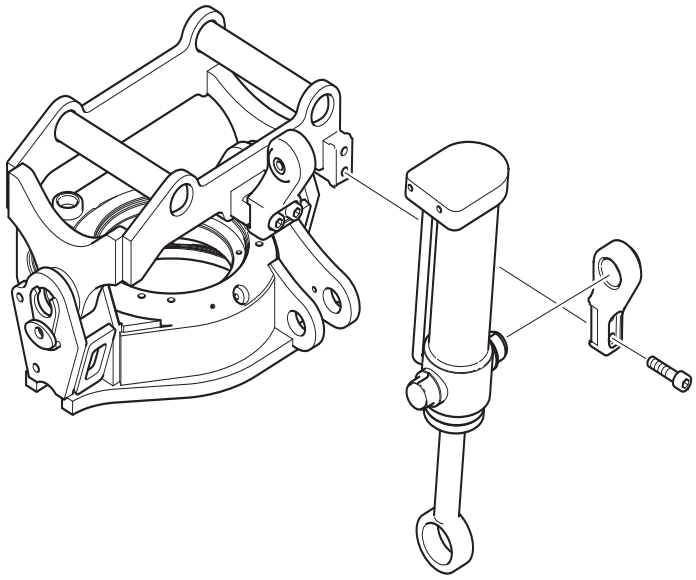


Fig. 9. Tilt cylinder

8. Attach the cylinder shaft and the lock screw.
9. Connect the two hydraulic tubes to the tilt cylinder's valve block, following the markings made earlier.
10. Connect the two power plugs to the rotator's valve block.
11. Fasten the power cable firmly to the hydraulic tubes using cable ties.
12. Lubricate the tiltrotator. See the lubrication schedule in the instruction manual.

Directional valve/valve block, tilt cylinder

CAUTION

Make sure that the hydraulic system is free of pressure before starting work. Risk of personal injury.

NB:

All work that involves opening up connections to hydraulic parts requires a high degree of cleanness.

NB:

All work on the hydraulic system that involves dismantling of parts requires a high degree of cleanness.

Removal

1. Mark the positions of the two hydraulic tubes so that they can be replaced in the same position.
2. Disconnect the hydraulic tubes attached to connection A and connection B on the tilt cylinder's valve block.
3. Plug all open connections.

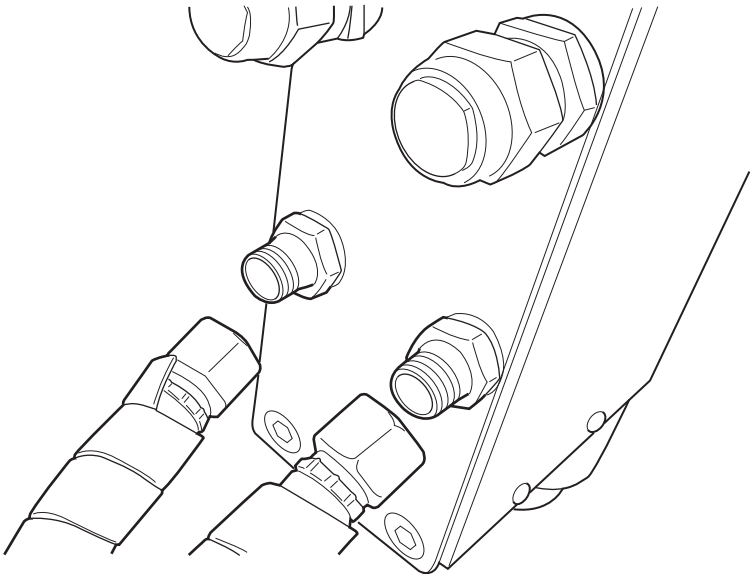


Fig. 10. Hydraulic connections, valve block

4. Undo the two screws that are screwed into the valve package (applies to protective plate without type plate).

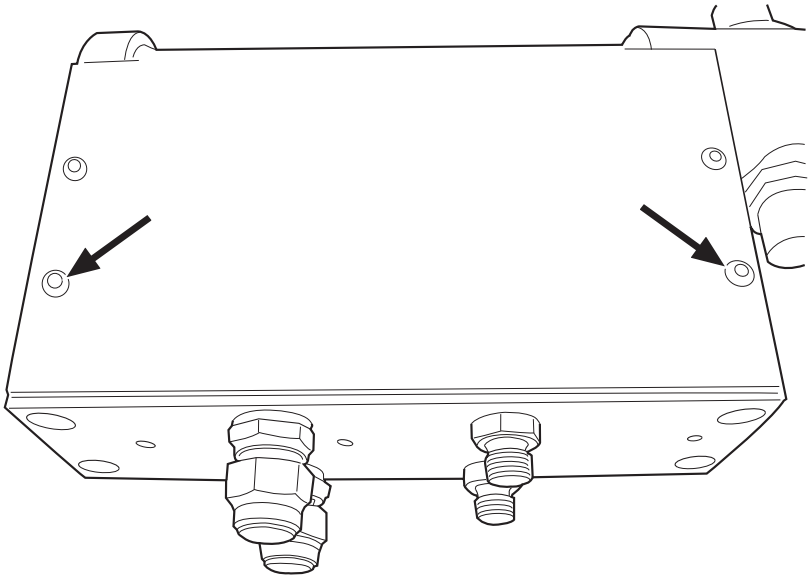


Fig. 11. Screws for protective plate without type plate

5. Remove the protective plate with a type plate.
6. Disconnect the three power plugs.
7. Remove the valve block from the tilt cylinder, making sure that the O-rings come away with it.
8. Remove the directional valve from the valve block.
9. Plug all open connections.
10. Remove the plastic nuts on the electromagnets and pull the electromagnets off the directional valve.

NOTE:

Reserve the O-rings for later.

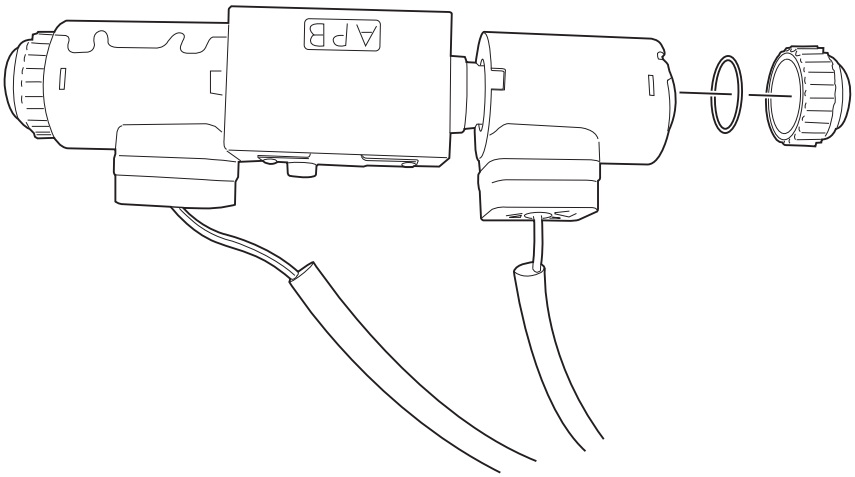


Fig. 12. Directional valve

11. Replace any damaged parts.

Attachment

1. Attach the electromagnets on the directional valve.
2. Lubricate the O-rings and thread them onto the directional valves.
3. Attach the plastic nuts.
4. Connect the directional valve to the valve block.
5. Attach the valve block to the tilt cylinder. Check that the O-rings are correctly in place.
6. Connect the three power plugs.
7. Make sure that the cables are positioned correctly and are not rubbing against any edges.
8. Attach the protective plate and tighten the screws.
9. Connect the two hydraulic tubes to the valve block, following the markings made earlier.

Directional valve/valve block, frame

Removal

1. Undo the two power plugs on the directional valves.
2. Remove the directional valves from the valve block.
3. Plug all open connections.
4. Remove the plastic nut for each electromagnet and pull them off the directional valve.

NOTE:

Reserve the O-rings for later.

5. Replace any damaged parts.

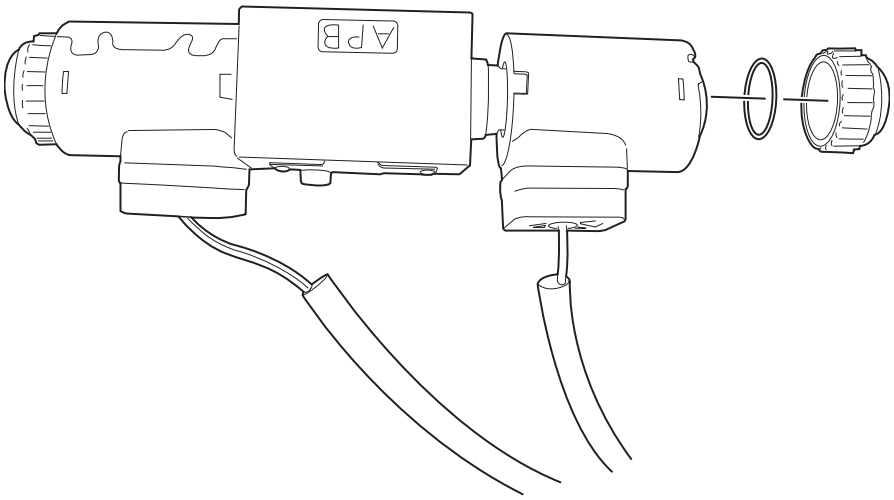


Fig. 13. Directional valve

Attachment

1. Attach the electromagnets on the directional valve.
2. Lubricate the O-rings and thread them onto the directional valves.
3. Attach the plastic nuts.
4. Attach the directional valves on the valve block.
5. Connect the power plugs to the directional valves.

Head

CAUTION

Make sure that the hydraulic system is free of pressure before starting work. Risk of personal injury.

NB:

All work that involves opening up connections to hydraulic parts requires a high degree of cleanness.

Removal

1. Remove the tilt cylinder according to the instructions in the section Tilt cylinder, Removal, steps 1-9.
2. Remove the lock screws for the tilt shafts on the head and remove the tilt shafts.
3. Remove the head.
4. Check the head for cracks and other damage. Replace or repair if necessary.

Attachment

1. Lubricate the bushes for the tilt shafts.
2. Lift the head into place and attach the tilt shaft that is turned away from the base machine.
3. Attach the tilt shaft that is turned towards the machine, and push it in until it reaches the inner edge of the shaft hole on the head.

NB:

Do not use shims on the front end. Risk of material damage.

4. Shim the head into place, positioning the shims on the inside at the rear end.

NOTE:

There must be no perceivable play after attachment and shimming.

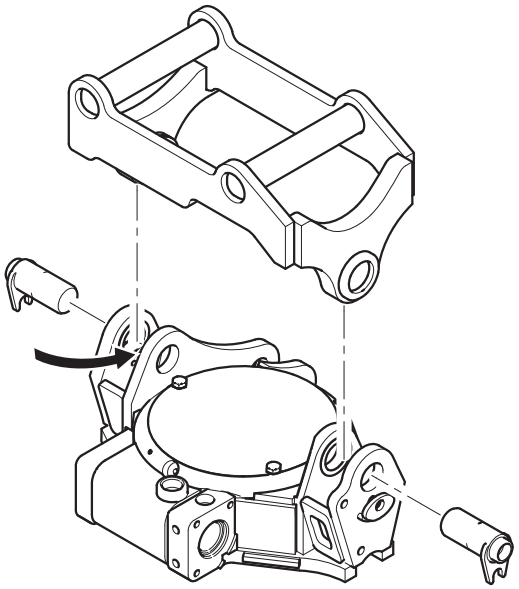


Fig. 14. Shimming, head

5. Attach the lock screw for the tilt shafts.
6. Lubricate the bushes for the tilt cylinder.
7. Attach the tilt cylinder according to the instructions in the section Tilt cylinder, Attachment, steps 5-11.

Hydraulic motor

CAUTION

Make sure that the hydraulic system is free of pressure before starting work. Risk of personal injury.

NB:

All work that involves opening up connections to hydraulic parts requires a high degree of cleanness.

NOTE:

Dismantling instructions for each type of hydraulic motor are included with the seal kit when spare parts are ordered.

Removal

1. Remove the motor guard.
2. Clean the motor and connections.
3. Mark the positions of the two hydraulic tubes so that they can be replaced in the same position.
4. Disconnect the tubes from the hydraulic motor.
5. Plug all open connections.

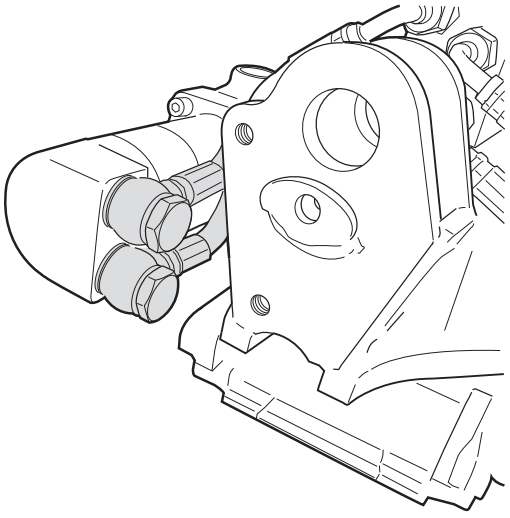


Fig. 15. Hydraulic connections, hydraulic motor

6. Remove the screws from the hydraulic motor and remove the motor.

Attachment

1. Attach the hydraulic motor and tighten the screws.
2. Connect the tubes for the hydraulic motor, following the markings made earlier.
3. Attach the motor guard.

Worm screw

Removal

1. Remove the hydraulic motor according to the instructions in the section Hydraulic motor, Removal.
2. Remove the screw housing for the worm screw.
3. Remove the worm screw washer along with the corresponding shims. A jig is required for this operation.

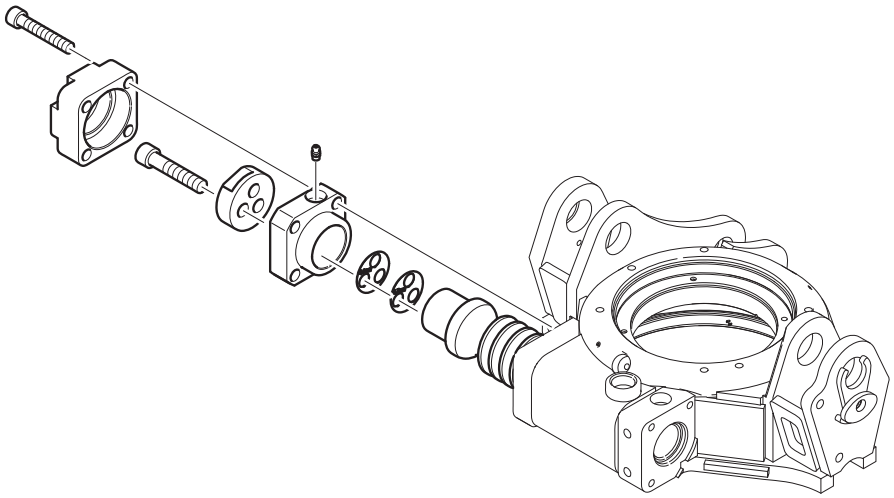


Fig. 16. Worm screw

4. Remove the screw bush.
5. Remove the worm screw.
6. Check all seals and wear parts for damage and wear. Replace any damaged or worn parts.

Attachment

1. Lubricate the worm screw bushes.
2. Put together the worm screw, screw bush and screw washer with shims.

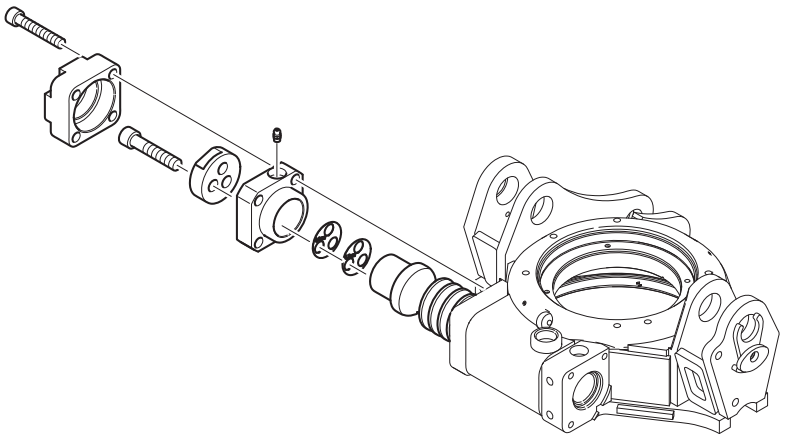


Fig. 17. Worm screw

3. Check that the screw can be turned in the screw bush, then attach the worm screw in the frame.
4. Attach the screw housing for the worm screw.
5. Turn the lower part clockwise to make sure that the worm screw reaches the bottom.
6. Install the dial indicator and tool 1004806 in one of the screw holes for the hydraulic motor. Set the dial indicator to zero.

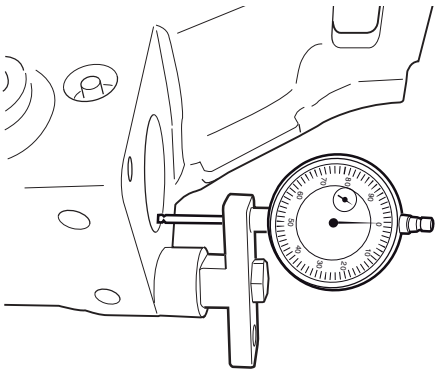


Fig. 18. Installation, dial indicator

NOTE:

When checking the play, make sure that the lower part and frame do not rotate in relation to each other.

7. Turn the lower part anti-clockwise. Check that the play is within the specified tolerance. If there is too much play, the worm screw must be reshimmed.
8. Reinstall the hydraulic motor according to the instructions in the section Hydraulic motor, Attachment.

Worm wheel

Removal

1. Remove the tilt cylinder according to the instructions in the section Tilt cylinder, Removal, steps 1-9.
2. Remove the lock screws from the tilt shafts on the head and remove the tilt shafts.
3. Remove the head.
4. Remove the indicator rod on the quick hitch.
5. Use an iron bar and a spacer to hold the locking wedge in place.
6. Remove the reamed bolt for the lock cylinder.
7. Carefully allow the iron bar to slide forwards until the tool springs are free from pressure. Remove the locking wedge and the tool springs.

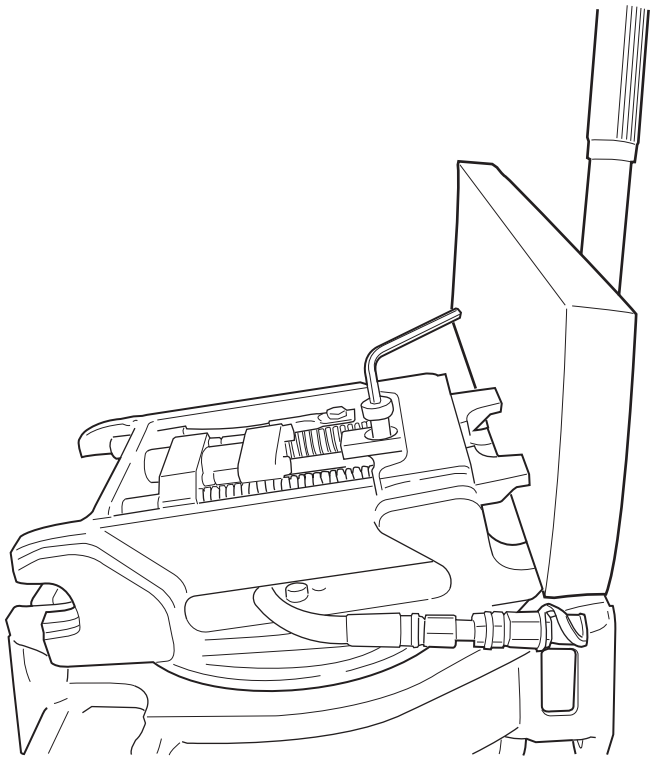


Fig. 19. Jig, tool springs

8. Mark the positions of the two tubes on the lock cylinder.
9. Remove the two tubes from the lock cylinder on the swivel.

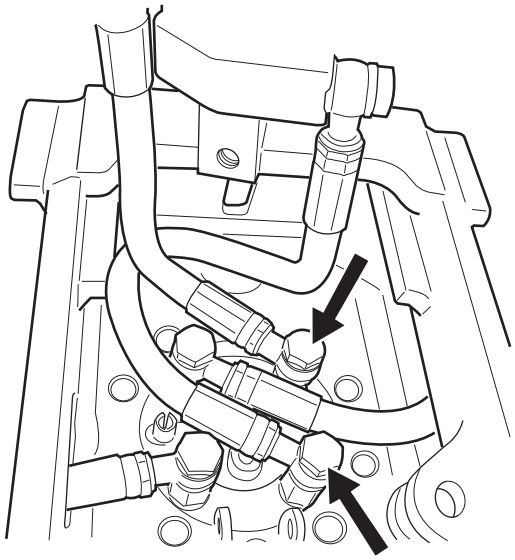


Fig. 20. Tubes, lock cylinder

10. Remove the cylinder.
11. Plug all open connections.
12. Mark the positions of the tubes for extra equipment.
13. Remove the tubes.

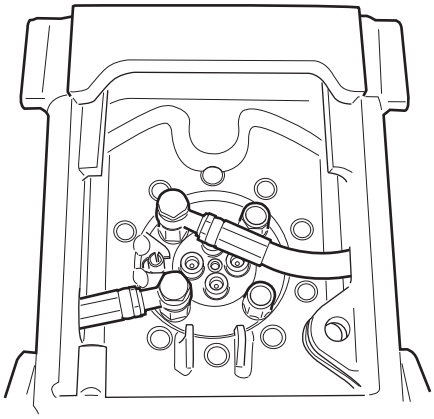


Fig. 21. Tubes, extra equipment

14. Plug all open connections.
15. Mark the positions of the two hydraulic tubes connected to the hydraulic motor, so that they can be replaced in the same position.
16. Disconnect the tubes from the hydraulic motor.

17. Plug all open connections.

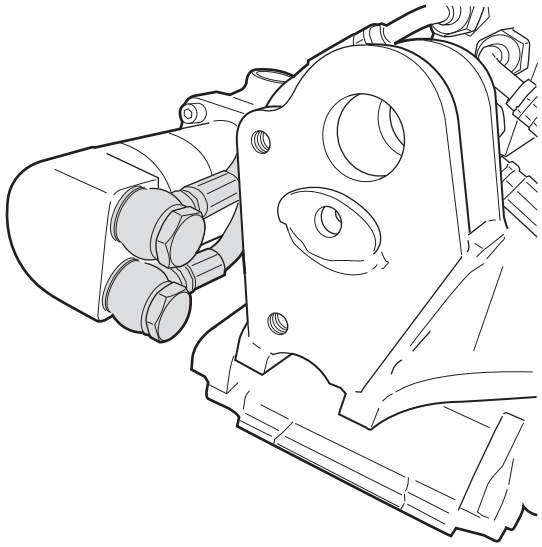


Fig. 22. Hydraulic connections, hydraulic motor

18. Remove the screws from the hydraulic motor and remove the motor.
19. Remove the directional valves, making sure that the O-rings remain in place.
20. Undo the screws for the cover plate and remove the valve block with the swivel.

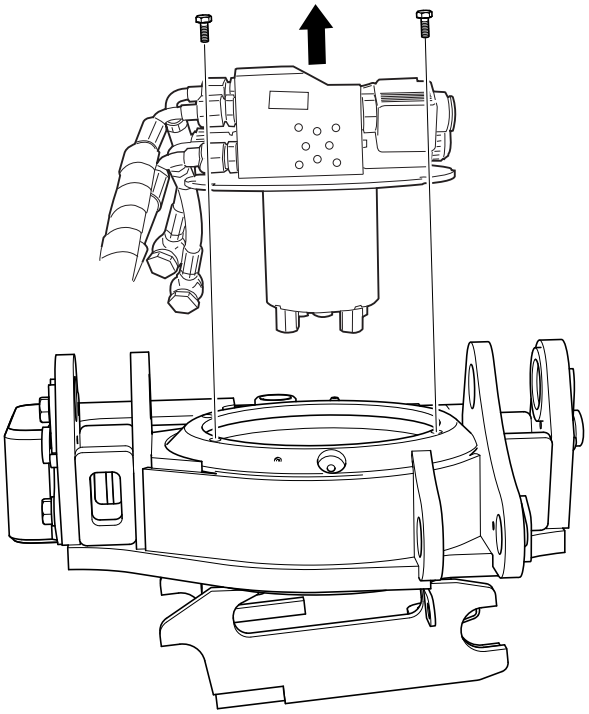


Fig. 23. Removal of swivel

21. Remove the screw housing for the worm screw.

22. Remove the washer for the worm screw with the shim.
    A jig is required for this operation.

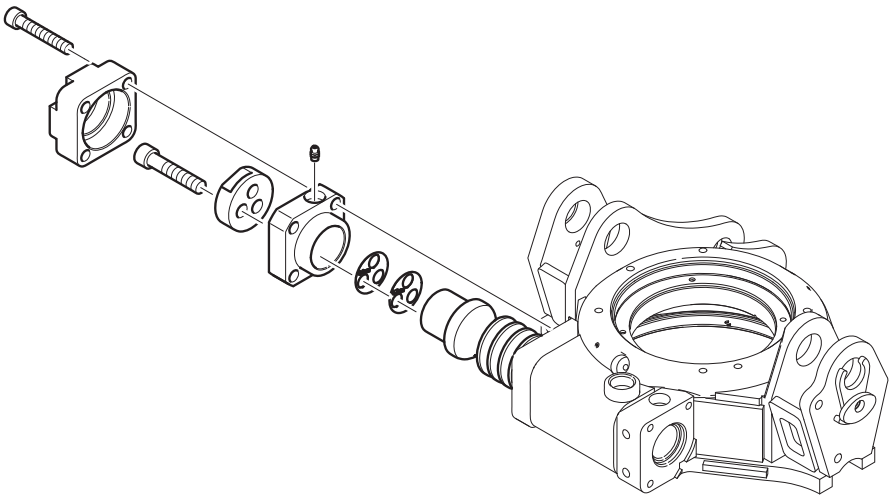


Fig. 24. Worm screw

23. Remove the screw bush and the worm screw.
24. Remove the screws for the worm wheel/quick hitch.
25. Remove the quick hitch.
26. Remove the scraper for the quick hitch.
27. Undo the two hex screws for the centre ring.

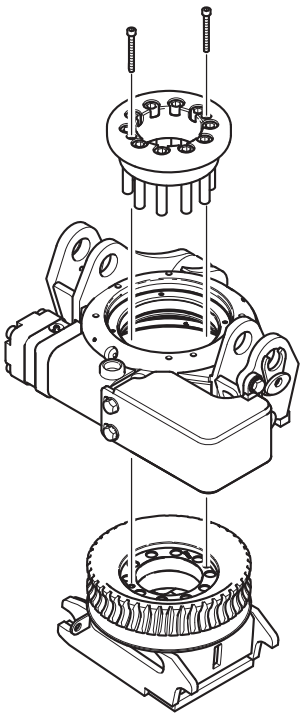


Fig. 25. Hex screws, centre ring

28. Lift out the worm wheel.

29. Remove the shims.

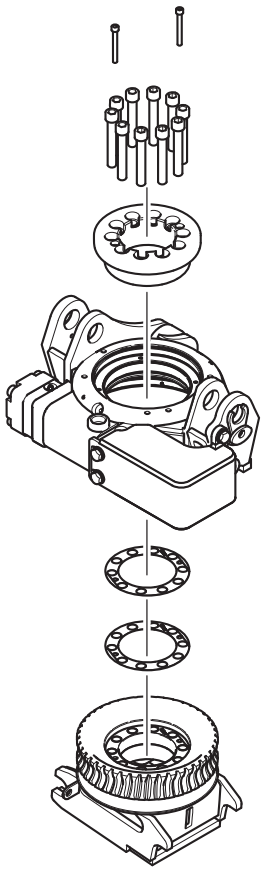


Fig. 26. Shims, worm wheel

30. Remove the centre ring.
31. Remove the wear washer, wear ring, guide bush and scraper for the centre ring.
32. Check all seals and wear parts for damage and wear.
    Replace if necessary.

Attachment

1. Attach the wear washer, checking that it is aligned with the lubrication groove.

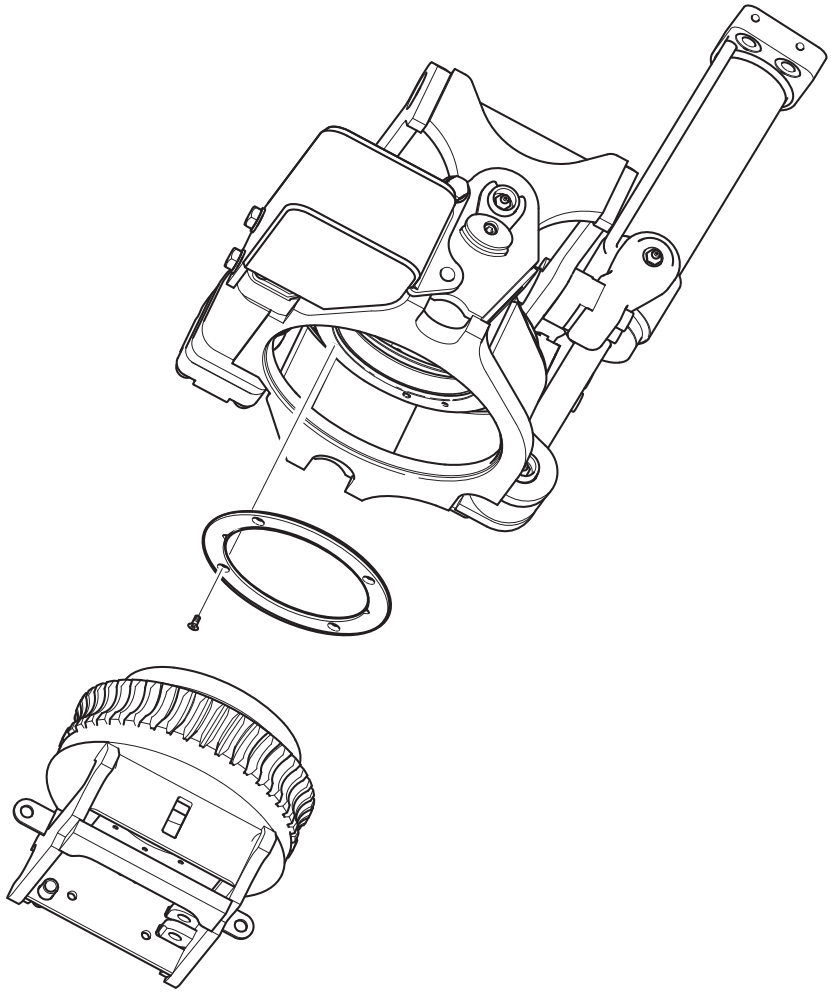


Fig. 27. Wear washer

2. Attach the wear ring. Check that the guide pin is not protruding above the wear washer.
3. Attach the scraper for the centre ring and the guide bush.
4. Attach the centre ring.
5. Attach the shim and lubricate the wear washer/wear ring.
6. Attach the worm wheel.
7. Tighten the worm wheel/centre ring with the two hex screws (M6).
8. Insert two screws through the holes in the worm wheel and put a flat bar between them to keep the iron bar in place.

9. Measure the axial play around the worm wheel, using a dial indicator and iron bar.

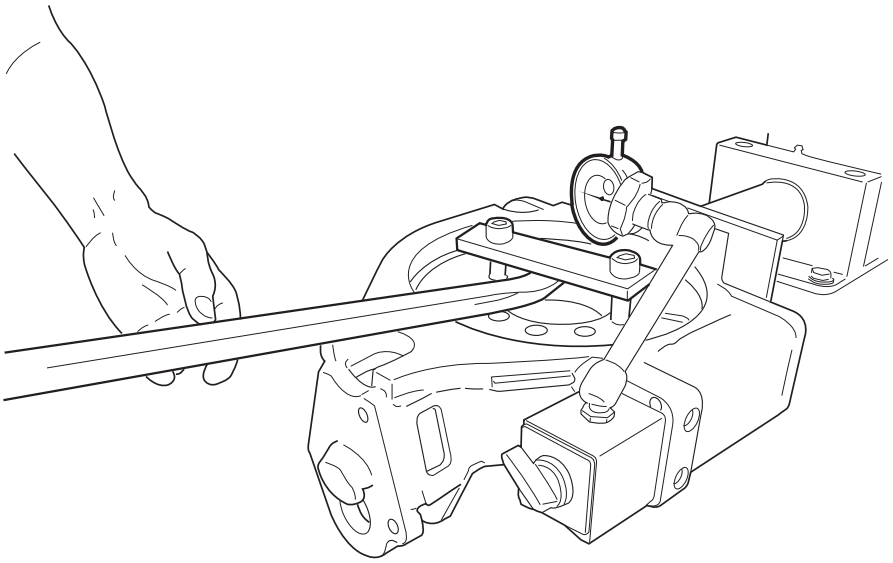


Fig. 28. Measurement, play

10. Max. play: 0.3 mm. If the play exceeds the tolerance, the rotor must be reshimmed.

NOTE:

Make sure that the groove for the scraper is clean, so that the new scraper can be positioned correctly.

16. Put together the worm screw, screw bush and screw washer with shims.
17. Check that the screw can be turned in the screw bush, then attach the worm screw in the frame.
18. Attach the screw housing for the worm screw.
19. Turn the lower part clockwise to make sure that the worm screw reaches the bottom.
20. Install the dial indicator and tool 1004806 in one of the screw holes for the hydraulic motor. Set the dial indicator to zero.

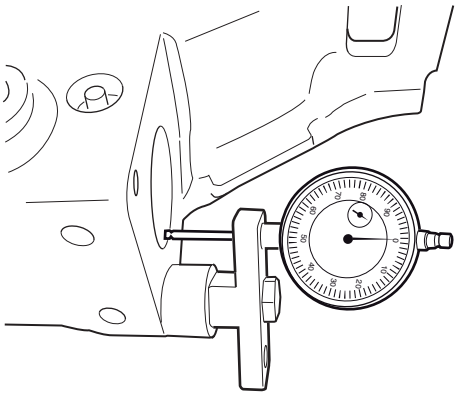


Fig. 29. Dial indicator

NOTE:

When checking the play, make sure that the lower part and frame do not rotate in relation to each other.

21. Turn the lower part anti-clockwise. Check that the play is within the specified tolerance. If there is too much play, the worm screw must be reshimmed.
22. Attach the hydraulic motor and tighten the screws.
23. Attach the valve block with the swivel. Check that the pin on the swivel fits the notch on the hitch.

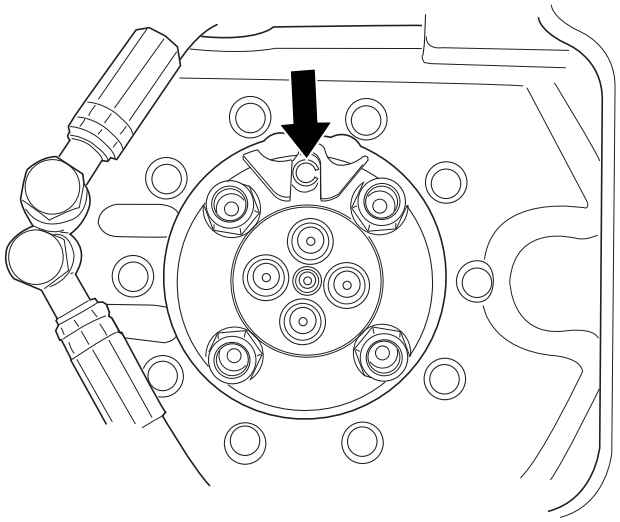


Fig. 30. Swivel pin fitted correctly in notch

24. Check that all the O-rings are correctly in place on the directional valves.
25. Attach the directional valves.
26. Attach the tubes on the hydraulic motor, following the markings made earlier.
27. Attach the motor guard.
28. Attach the tubes for extra equipment, following the markings made earlier.

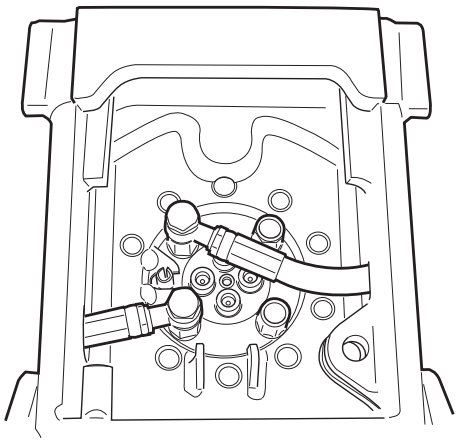


Fig. 31. Tubes, extra equipment

29. Attach the tubes to the lock cylinder, following the markings made earlier.

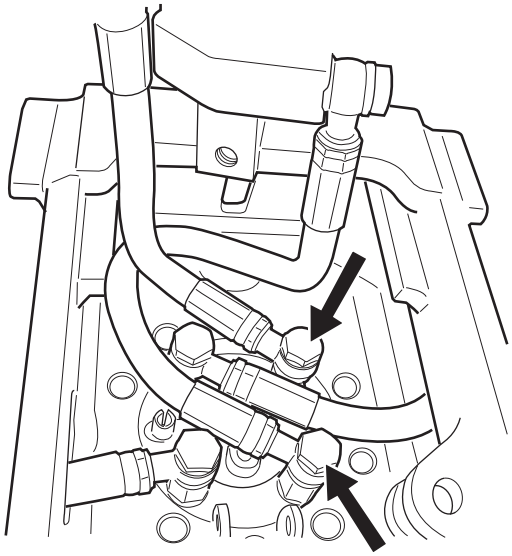


Fig. 32. Tubes, lock cylinder

30. Attach the lock cylinder with spacers. Do not tighten the fastenings.
31. Attach the tool springs and the locking wedge. Use an iron bar with a spacer to compress the springs.
32. Attach the reamed bolt for the lock cylinder.
33. Tighten the hex screws on the lock cylinder.

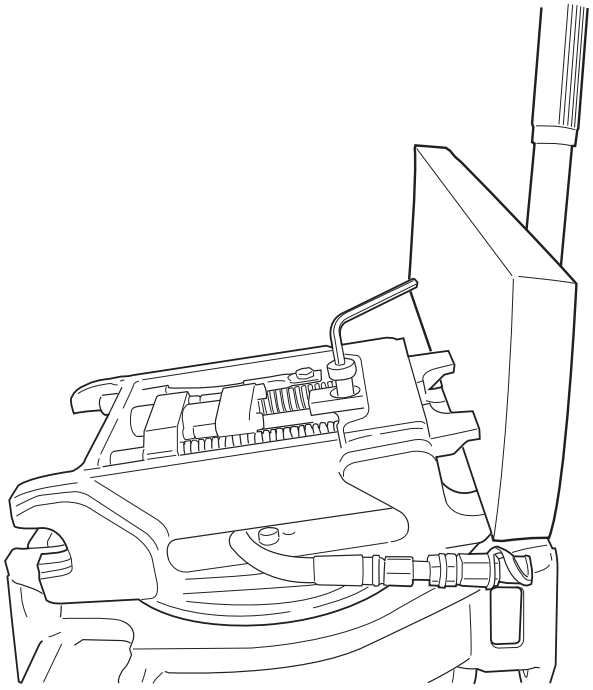


Fig. 33. Jig, tool springs

34. Attach the indicator rod to the quick hitch.
35. Attach the head.
36. Attach the tilt shaft that is turned away from the machine.

37. Attach the tilt shaft that is turned towards the machine, and push it in until it reaches the inner edge of the shaft hole on the head.

NB:

Do not use shims on the front end. Risk of material damage.

38. Shim the head into place on the inside at the rear end.

NOTE:

There must be no perceivable play after attachment and shimming.

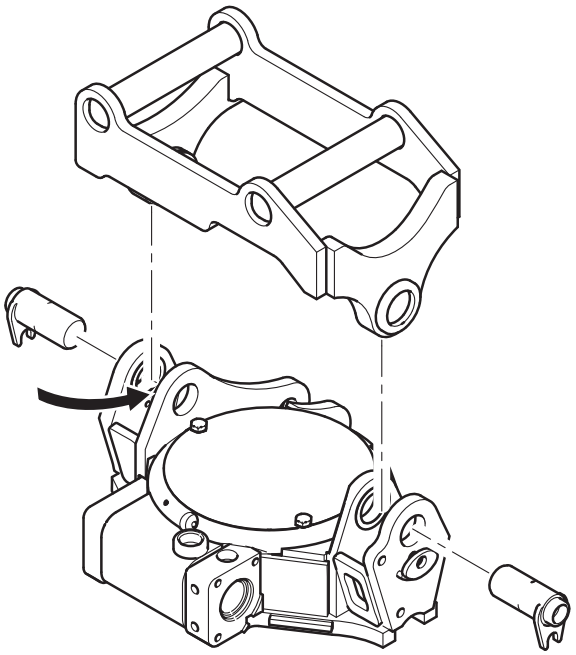


Fig. 34. Shimming, head

39. Attach the lock screws for the tilt shafts.
40. Attach the tilt cylinder according to the instructions in the section Tilt cylinder, Attachment, steps 5-11.

Checking of axial play

Axial play, worm wheel

If there is no hole for mounting the gauge:

1. Drill a hole measuring 8.5 mm in the cover plate as shown in fig. 38.
2. Probe with the tool R1/8.

NOTE:

Plug the hole after finishing the operation.

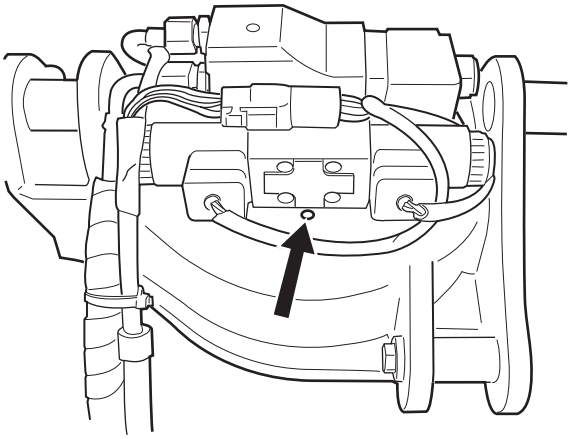


Fig. 35. Position

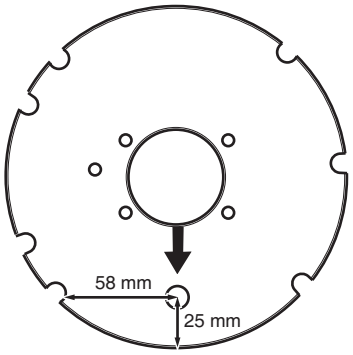


Fig. 36. Measurement table

Checking of play

1. Remove the directional valve for rotation.

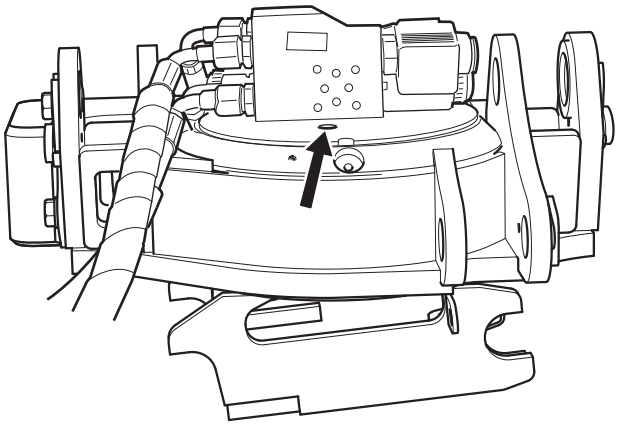
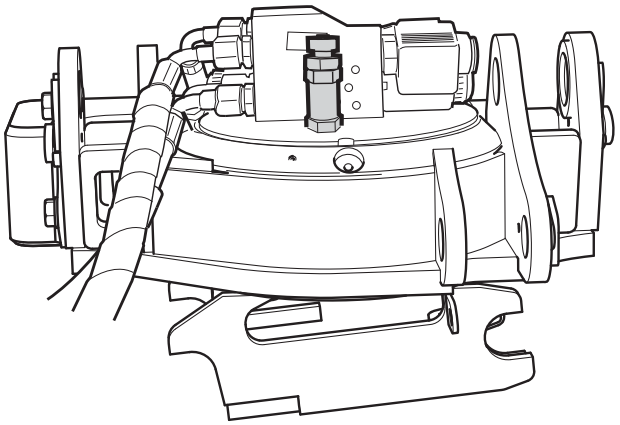


Fig. 37. Directional valve for rotation removed

2. Attach the tool for checking the axial play.



1. 1004707
2. 610906
3. 1004720
4. 1004809

Fig. 38. Tool for checking play

3. Set the gauge to zero against one of the flat surfaces with the rotor resting flat against the ground.

NOTE:

Check the play by lifting the rotor up from the ground.

4. Probe with an iron bar between the hitch and frame to make sure that there is room for maximum play. Check that the play is within the indicated tolerance. If there is too much play, the rotator must be reshimmed.
5. Reshim according to the instructions in the section Worm wheel, Removal/Attachment.
6. Attach the directional valve for rotation.

Axial play, worm screw

Checking of play

1. Remove the hydraulic motor according to the instructions in the section Hydraulic motor, Removal.
2. Turn the lower part clockwise to make sure that the worm screw reaches the bottom.
3. Attach the gauge and tool 1004806 and reset it to zero against one of the flat surfaces.

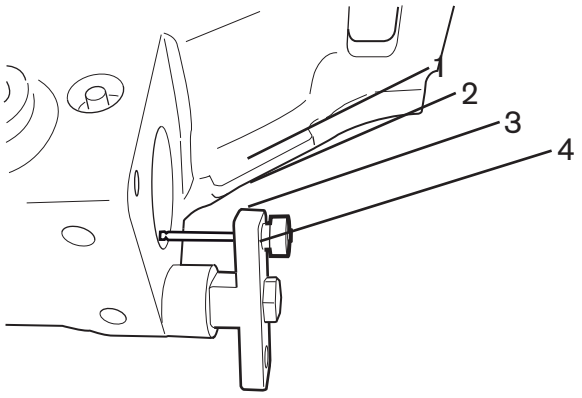


Fig. 39. Gauge

NOTE:

When checking the play, make sure that the lower part and the frame do not rotate in relation to each other.

4. Turn the lower part anti-clockwise and check that the play is within the specified tolerance. If there is too much play, the worm screw must be reshimmed.
5. Reshim according to the instructions in the section Worm screw, Removal/Attachment.
6. Attach the hydraulic motor according to the instructions in the section Hydraulic motor, Attachment.

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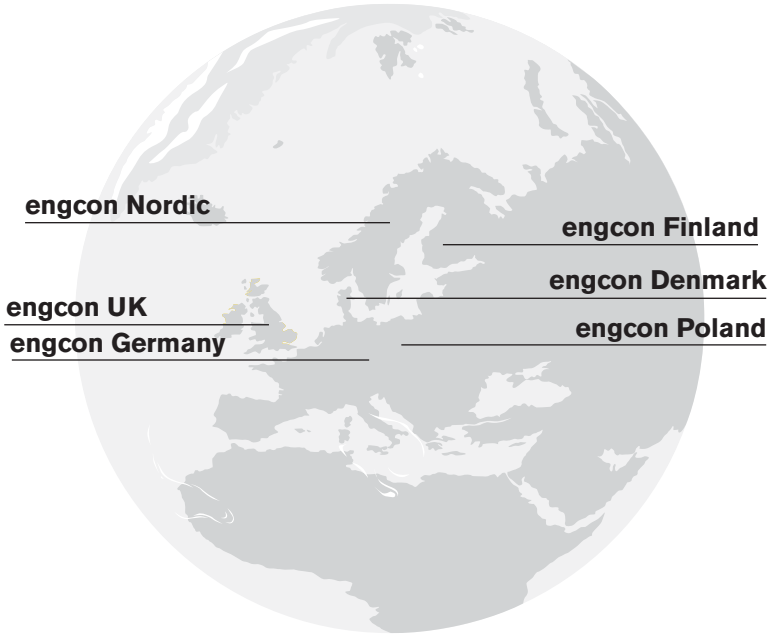

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